Six sigma scale as a quality criteria on aggregation of food property measures

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Loosing my Duff!!

Foods with Generic Name?

Vitamin B12 reference values for Popcorns!

Drinking BUZZ -Cola Telling Cola!
Outline

- Aggregation concepts in Food Composition
- Six Sigma methodology and Westgard Method Evaluation Decision Chart
- Six Sigma in Food Composition Compilation Process
- Case Studies
  - Laboratory selection
  - Laboratory performance
- Conclusions
Aggregation Concept

CEN/TC 387 - Standards under development

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<th>Title</th>
<th>Candidate citation</th>
<th>Current status</th>
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Quality Tools in Aggregation

Representative values

Differences between analytical values

Natural or Artefactual differences

How to express the quality of analytical performance

Selenium in sardines (ug/100mg)

<table>
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<tr>
<th>Lab</th>
<th>Mean</th>
<th>Maxi</th>
<th>Mini</th>
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Six Sigma Strategy

- Six Sigma is a total quality management concept introduced by Westgard(1) in clinical laboratories with the purpose to quantify laboratory test performance.

- Laboratory Performance for a specific analyte is defined by a sigma level expressing compliance with requirements estimated using the following equation:
  \[ \sigma = \frac{(TEa-bias)}{CV} \]

  TEa (Allowable total measurement error)
  Quality Control data is used to estimate Bias and CV

- Metrics: Quality measurement procedure in a sigma scale
  - 6-5 \( \sigma \) Excellent, 4 \( \sigma \) Good, 3 \( \sigma \) Acceptable, 2 \( \sigma \) Poor

(1) http://www.westgard.com/
Method Evaluation Decision Chart

- **Equation**
  - $\text{TEa} = |\text{Bias}| + z\text{*s} ;$

- **Criteria to define tolerance intervals**
  - Reference Method – ISO, AOAC, NKML, CEN
  - Method Performance ($RSD_R$ and $Sr$)
  - Collaborative Studies (intercomparisons)
    - Maximum Difference Between Lab : 20%
    - CV 10 %
  - Recovery
    - Minimum 80 %
  - Reference Materials
    - Value accepted in the certified range

*Holden et al, 2005*
Selenium in fish

- To determine selenium in fish a group of laboratories were invited to participate in a collaborative study

- Homogeneized samples with selenium certified value was distributed among laboratories

- Laboratories have to report method of analysis and digestion method

- Laboratories were selected/reject according to their contribution to aggregate value
**Laboratory Performance: case 1**

**Selenium in Tuna Fish**

**ICP-MS**

**Aggregate**

Sigma Level – 3.29
Metrics – Acceptable

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**Graph Details**

- **TEa%**
- **Allowable Inaccuracy D.B.L. (%)**
- **CV(%)**
- **Allowable Imprecision (%)**

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Laboratory Performance: case 1

Selenium in Tuna Fish
ICP-MS

Aggregate Sigma Level – 4,23
Metrics – Good

Allowable Imprecision (%)

Allowable Inaccuracy D.B.L. (%)

0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00

0.00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00

TEa%
Apples – $\beta$ Carotene

Raw data was selected from three scientific papers

Reference Values for Quality Control were obtained from EN 12823-2

Laboratory Performance was assessed using data from in-house method validation: recovery and $\text{cv}$

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Laboratory Performance: case 2

β-Carotene

Aggregate Sigma Level 2,89 Metrics - Poor

Allowable Imprecision (%)

Allowable inaccuracy - Recovery (%)
Riboflavin in Mushrooms

Raw data was selected from three scientific papers

TEa was calculated from CRM 421 Certification Campaign

Laboratory Performance was assessed using data from:
• Participation in PT schemes
• CRM obtained values
Laboratory Performance: case 3

Riboflavin in mushrooms

Aggregate
Sigma Level 3,26
Metrics - Acceptable

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Fiber in bread

- Raw data was collected from laboratory reports.
- Reference values were selected from FAPAS report.
- Laboratories were assessed by criteria defined in ILAC g22:2004.
Laboratory Performance case 4

Total Dietary Fiber – Prosky method

Aggregate:
Sigma level: 3,25
Metrics - Acceptable
Cholesterol in meat

- Data was collected from three scientific papers
- Reference values were achieved using DQES/USDA criteria for certified reference materials
- Laboratories performance was assessed by comparison analytical with values in the certificate.
Laboratory Performance: case 5

Cholesterol in meat

Aggregate Sigma Level 4.89
Metrics - Good

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Conclusions

- Improvements in laboratory selection and data quality for customizing user interaction are the main contributions of six sigma approach.

- Six Sigma, MEDx are suited techniques to support the decision of aggregate values to guarantee the transparency of the process and enhancing FCDBs users satisfaction.

- These techniques are able to refine the quality techniques already in place and taken them to the next level of improvement.
Six Sigma applied in Compilation Process is a contribution to reduce artefactual differences when calculating and comparing nutrient intake based on different food composition datasets.
I need a word with Joanne

Wheat with high Protein Content
Thanks for your attention